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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

VALENCIA, DANIEL E

ART UNIT	PAPER NUMBER
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2874

DATE MAILED: 06/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/010,786

Applicant(s)

NOVOTNY ET AL

Examiner

Daniel E Valencia

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 and 12-60 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 26 and 32-34 is/are allowed.
- 6) ☒ Claim(s) 1-10, 12-21, 23-25, 27-30, 35-38, 41-44 and 47-60 is/are rejected.
- 7) ☒ Claim(s) 22, 31, 39, 40, 45 and 46 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Applicant's communication filed on April 18, 2003 has been carefully studied by the Examiner. In accordance with the communication, claims 1, 9, 10, 25, 26, and 28 have been amended, claim 11 has been cancelled, and new claims 35-60 have been acknowledged.

Information Disclosure Statement

The information disclosure statement filed April 18, 2003 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Response to Arguments

Applicant's arguments with respect to claims 1-30 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3, 4, 6, 9, 10, 25, 27, 28, and 35 are rejected under 35 U.S.C. 102(e) as being anticipated by Hong U.S. Patent Application Publication No. 2003/0031451 A1.

Refer to the appropriate drawings or parts of the specification. Hong discloses a variable optical attenuator of optical path conversion with all the limitations of the abovementioned claims. Regarding claims 1, 25 28, Hong discloses a device, comprising: a substrate; a first fiber having a first facet and fixed on said substrate; a second fiber, fixed on said substrate and parallel to said first fiber, having a second end facet which opposes said first end facet by a gap to directly receive light from said first end facet without coupling optics therebetween; a blade having a first blade surface facing said first end facet and forming a first angle with respect to said first end facet and a second blade surface facing said second end facet and forming a second angle with respect to said first blade surface, said blade movably engaged to said substrate to move in and out of said gap at various positions some of which allow said blade to intercept at least a portion of the beam in said gap to vary an amount of light directly coupled from said first fiber into said second fiber; and an actuator located on said substrate and engaged to said blade to control motion of the blade, wherein said actuator is an integrated micro mechanical device with a stationary part and a movable part with a first set of movable conductive teeth, said movable part movably engaged to said stationary part to have positions at which said movable teeth spatially interleave

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with said stationary conductive teeth to electrostatically interact to control movement of said movable part in response to a control voltage applied between said stationary conductive teeth and said movable conductive teeth. Hong discloses that that blade is reflective and is set at an initial position in which the blade does not intercept the beam in the gap, as described in claims 3 and 4. As to claims 6, 9, and 10, Hong discloses that the end facets of the first and second fibers are substantially perpendicular to optical axes of said first and second fibers which substantially coincide and the second blade surface is substantially parallel to the second end facet, wherein said second blade surface forms a third angle with respect to said second end facet. Hong's disclosure shows that the blade surfaces are non-parallel, as mentioned in part of claim 35. With reference to claim 27, Hong discloses that a fraction of the light is coupled through the gap and the amount coupled depends on the position of the blade. It would be inherently disclosed by the reference that at some point in the attenuation process the optical signal would be converted to an electrical signal in order to control the position of the blade.

Examiner would also point out that the Applicant's references to a first, second, third respective angles in some of the claim language could be interpreted broadly to include a first, second, and third angle of 0°.

Claims 35, 36, 42, 47, 48, and 49 are rejected under 35 U.S.C. 102(e) as being anticipated by Al-hemyari U.S. Patent No. 6,563,965. Refer to the appropriate drawings or parts of the specification. Al-hemyari discloses an analog optical switch using an

integrated Mach-Zehnder interferometer having a movable phase shifter with all the limitations. Regarding claims 35, 36, 42, and 49, Al-hemyari discloses a device comprising: a first facet launching beam; a second facet separated from the first facet by a gap and receiving the beam; a blade extending through the gap and intersecting at least a portion of the beam, the blade attenuating the portion of the beam by refraction; an electromechanical actuator connected to the blade and adjusting the blade within the gap in response to control signals; and a control circuit electrically connected to the actuator and generating control signals.

Al-hemyari does not explicitly state that his device is an attenuator; however, this would be an inherent function of such a device. Additionally, Al-hemyari discloses that the actuator is an electromechanical actuator. Since these electromechanical actuators cannot operate without an electrical signal coming from some circuit, the control signal and control circuit limitations would be inherently disclosed by the reference.

Al-hemyari's disclosure shows that the blade includes a first blade surface facing the first facet and a second blade surface facing the second facet, wherein the first and second blade surfaces are nonparallel, as explained in claims 35 and 47. Referring to claim 48, Al-hemyari's disclosure shows that the blade is transparent.

Claims 54-58 and 60 are rejected under 35 U.S.C. 102(e) as being anticipated by Liu U.S. Patent Application Publication No. 2003/0053743 A1. Refer to the appropriate drawings or parts of the specification. Regarding claim 54, Liu discloses an attenuator comprising: a substrate; a first facet connected to the substrate and launching a beam

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in a first direction substantially parallel to the substrate; a second facet connected to the substrate, the second facet separated from the first facet by a gap and positioned to receive the beam; a blade extending through the gap and intersecting a portion of the beam, the blade including a first blade surface reflecting some of the portion of the beam in a second direction substantially parallel to the substrate; and an electromechanical actuator connected to the blade and adjusting the blade within the gap. Liu's disclosure also shows that the first surface is substantially planar defining a plane substantially normal to the substrate, as mentioned in claims 55 and 56.

Referring to claim 57, Liu discloses that the electromechanical actuator has a rotational axis, and wherein the first blade surface deflects the portion of the beam away from the rotational axis. Liu's disclosure further shows that the blade includes a second blade surface opposite the first blade surface and passing a second portion of the beam, as mentioned in claim 58. As to claim 60, Liu's disclosure shows that the facets are the ends of optical fibers.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 7, 8, 12-15, 29, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong in view of Aksyuk U.S. Patent No. 6,173,105. Refer to the

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appropriate drawings or parts of the specification. Hong as applied above, discloses a variable optical attenuator with a majority of the limitations of the claimed invention including those described in claims 14 and 15. However, the reference fails to teach the use of a rotational actuator, anti-reflective coating, a feedback loop, or a gap width.

On the other hand, Akshuk discloses an optical attenuator that teaches the limitations that the Hong reference lacks. Regarding claim 7, Akshuk discloses that the end facets of the two fibers are coated with anti-reflective coating. Akshuk further discloses that the end facets of the first and second fibers form an angle with respect to optical axes of said first and said second fibers, respectively, and wherein said first fiber is spatially shifted from said second fiber to allow for maximum coupling efficiency from said first fiber to said second fiber when blade does not intercept the light, as described in claim 8. With reference to claim 12, Akshuk discloses that the actuator is a rotational actuator, the device further comprising an arm having one end engaged to said actuator and an opposite end engaged to said blade, said arm amplifying a motion of said actuator to be greater motion of said blade. Akshuk discloses that the device further comprises an optical coupler to split a fraction of light received by said second fiber from said second end facet to produce a monitor beam; an optical detector to receive said monitor beam to produce a detector output; a feedback circuit coupled to said optical detector and said actuator to control a position of said blade to control an amount of light received by said second fiber in response to said detector output (fig 3 and col. 5, lines 1-20), as described by instant claim 13. As to claims 29 and 30, Akshuk discloses

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that the gap width is 20 microns (col. 4, line 54), which falls within the range described by the claimed invention.

Aksyuk teaches that it is advantageous to use a coupler to split a fraction of the light in order to monitor and be able to control the attenuation of the optical signal (col. 5, lines 1-15). Additionally, the reference teaches that anti-reflective coating on the two fiber facets provides the benefit of not allowing the optical signal to be reflected back through the fiber when it reaches the facet-gap interface (col. 2, lines 1-7). Since Hong and Aksyuk are both from the same field of endeavor, the purpose disclosed by Aksyuk would have been recognized in the pertinent art of Hong. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Aksyuk to the device disclosed by Hong.

Claims 43, 44, and 50-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Al-hemyari in view of Hong. Refer to the appropriate drawings or parts of the specification. Al-hemyari as applied above, discloses a device that acts as an attenuator with a majority of the claimed limitations including most of the limitations of claim 50-52. However, although the reference states that an electromechanical actuator may be used, the disclosure does not explicitly state the details of the actuator.

On the other hand, Hong discloses a similar attenuator that uses a MEMS comb driven actuator with movable teeth and stationary teeth to position the blade in the appropriate position, as described in claim 44. Hong teaches that it is advantageous to use a MEMS comb driven actuator, because it allows the blade to be displaced linearly

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in response to a control signal in order to control attenuation (paragraph 54).

Furthermore, Al-hemyari states that the device can employ an electromechanical actuator (col. 14, lines 63-bottom). It would have been obvious to one of ordinary skill in the art at the time of invention to use a comb-driven actuator in the device disclosed by Al-hemyari.

Additionally, Al-hemyari does not explicitly state that the control signal biases the actuator in a linear response range when intersecting a portion of the beam. However, one of ordinary skill in the art would first recognize that a MEMS device responds to an electrical control signal in a linear manner, as mentioned in claim 43. For example, the higher the voltage applied to an electrode, the greater the displacement ($D = Vx$). This type of relationship is well known in the MEMS actuator art. With reference to claim 53, an electromechanical actuator would by virtue be an electromagnetic actuator, because electric and magnetic fields are interdependent. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the movement of the blade would have a linear response with respect to the control signal in the device disclosed by Al-hemyari.

Claims 5, 19-21, 37, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong. Refer to the appropriate drawings or parts of the specification. Hong as applied above discloses a device comprising essentially all the elements of the claims; however, the reference does not explicitly state that the blade can be set in an

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initial position that obstructs the light, or that the displacement has a linear relationship with respect to the control signal.

On the other hand, Hong discloses a MEMS attenuator that meets essentially all the elements of the claims. First, one of ordinary skill in the art would recognize that a MEMS device responds to an electrical control signal in a linear manner, as mentioned in claims 5, 19, 37, and 38. For example, the higher the voltage applied to an electrode, the greater the displacement ($D = Vx$). This type of relationship is well known in the MEMS actuator art. Second, one of ordinary skill would recognize that this actuator could be biased in any position whether it corresponds to obstructing the light or passing the light, as mentioned in claims 20 and 21. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the movement of the blade would have a linear response with respect to the control signal and the blade could be initially positioned to obstruct the light.

Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong and Aksyuk '105 in view of Aksyuk U.S. Patent No. 6,075,239. Refer to the appropriate drawings or parts of the specification. Hong and Aksyuk as applied above disclose an optical attenuator with a majority of the limitations of the present invention; however, the combination of references fails to teach the use of serpentine hinges.

On the other hand, Aksyuk '239 discloses an article comprising a light actuated micromechanical photonic switch used as an attenuating device that teaches the limitation that that Hong and Aksyuk ' 105 lack. Regarding claims 23 and 24, Aksyuk

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'239 discloses a device with a movable blade for attenuating light in between optical fibers, wherein the actuator that drives the blade linearly includes two serpentine torsional hinges (fig 2 and fig 3). Both Hong and Aksyuk '105 and Aksyuk '239 disclose devices including a blade for insertion between fiber facets for attenuating light therebetween. Aksyuk '239 teaches that it is advantageous to use torsional serpentine hinges, because it allows the beam holding the blade to pivot (col. 6, lines 24-34). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use torsional serpentine hinges, shown in Aksyuk '239, in the device disclosed by Hong and Aksyuk '105.

Claims 2, 16-18, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong and Aksyuk in view of O'Keefe U.S. Patent No. 6,246,826. Refer to the appropriate drawings or parts of the specification. Hong and Aksyuk disclose an optical attenuator with a majority of the limitations of the present invention; however, the reference fails to mention that the blade or shutter of the attenuator can be made of transparent material or the different means of moving the blade mentioned in claims 16-18 and 41.

On the other hand, O'Keefe discloses a variable optical attenuator with a profiled blade that teaches the limitations that the Hong and Aksyuk combination lacks. Regarding claim 2, O'Keefe discloses that the blade used in the optical attenuator can be transparent (col. 6, lines 45-55). With reference to claims 16-18 and 41, O'Keefe teaches that his device can be used with actuators utilizing electromagnetic gears,

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thermal expansion, or movable piezo-electric elements (col. 2, lines 13-20). One of ordinary skill in the art would recognize the different ways of actuating as equivalent means. O'Keefe discloses a similar device that moves a blade in between two fiber end facets for intercepting some of the light. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use one of the other means of actuating to displace the blade in Hong and Aksyuk.

Claim 59 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu in view of Hong. Liu as applied above, discloses a variable optical attenuator with a majority of the limitations of the claimed invention. However, the reference does not explicitly state that the blade surfaces are nonparallel.

On the other hand, Hong discloses a similar variable optical attenuator that positions a blade in between two fibers, wherein the blade surfaces are nonparallel, as mentioned in claim 59. Hong teaches that it is advantageous to use an angled blade, because it allows the attenuated optical signal to be reflected along a path that does not coincide with the signal transmitted by the transmitting fiber. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use a blade that has nonparallel surfaces in the attenuator disclosed by Liu.

Allowable Subject Matter

Claims 26 and 32-34 are allowed.

Claims 22, 31, 39, 40, 45, and 46 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance: As to independent claim 26, the prior art alone or in combination fails to disclose or render obvious a method comprising: causing end facets of two fibers to face each other with a gap; causing said gap to be at a value to allow for direct optical coupling between said two fibers without coupling optics therebetween to have optical loss less than about 1dB; and causing a blade to move in said gap to interfere with said direct optical coupling by optical refraction or reflection, wherein said blade has a blade surface at an angle with respect to an end facer of a fiber that outputs light to said blade surface; wherein said blade is engaged to a rotational actuator which has a set of stationary teeth and a set of movable teeth interleaving with said stationary teeth, wherein said stationary and said movable teeth in response to a potential difference, the method further comprising: causing a bias in potential difference to make said rotational actuator respond approximately linearly and with damping with respect to a change in said potential difference. None of the cited prior art teaches or suggests the limitation of "damping with respect to a change in potential difference". This limitation is distinct from O'Keefe's teaching of using oil to damp motion within the package.

For reasons for allowance regarding claims 32-34, see the previous Office Action (Paper. No. 4, Page 9, paragraph 1).

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The following is a statement of reasons for the indication of allowable subject matter:

As to dependent claims 22, 40, and 46, the prior art alone or in combination fails to disclose or render obvious a device or attenuator with all the limitations of the respective independent and intervening dependent claims, wherein the circuit produces a bias signal to set a position at which the actuator is damped with respect to a change in a control signal to the actuator. None of the cited prior art teaches or suggests this limitation. This limitation is distinct from O'Keefe's teaching of using oil to damp motion within the package.

For reasons for indicating allowable subject matter regarding claim 31, see the previous Office Action (Paper No. 4, Page 8, paragraph 30).

With reference to dependent claims 39 and 45, the prior art alone or in combination fails to disclose or render obvious an attenuator with *all of the limitations of respective independent and intervening dependent claims*, wherein the actuator is also rotational actuator. The prior art does not teach an actuator having a combination of movable and stationary teeth, but also being a rotational actuator. For example, Hong discloses a comb driven actuator, having movable and stationary, teeth that is not rotational. Liu discloses a rotational actuator; however, the actuator does not have movable and stationary teeth. Aksyuk '239 discloses a rotational actuator; however, the actuator does not have movable and stationary teeth. None of the prior art suggests combining an actuator with teeth with a hinge in order to be able to linearly displace the blade as well rotate it.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Tei U.S. Patent No. 6,442,324 discloses an optical attenuator module that uses refraction to attenuate the signal.

Yan U.S. Patent No. 6,560,396 discloses a variable optical attenuator that uses refraction as a means of attenuating the signal.

Jaspan U.S. Patent No. 6,553,175 discloses a variable optical attenuator with a transmissive blade disposed in-between the facets of two fibers.

Eu U.S. Patent No. 6,^{222 656}~~553,175~~ discloses a variable optical attenuator especially relevant to the angled blade structure (fig. 7B).

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

The following new claim language required a new search, new consideration, and a new grounds of rejection.

1. "a first... and second blade surface facing said second end facet and forming a second angle with respect to said first blade surface..."
2. "nonparallel" requirement

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3. the limitation of attenuating by "refraction" rather than the previous "refraction or reflection".

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel E Valencia whose telephone number is (703)-305-4399. The examiner can normally be reached on Monday-Friday 9:30-6:00.

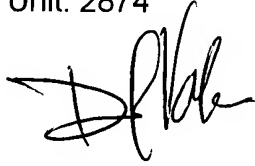
The fax phone numbers for the organization where this application or proceeding is assigned are (703)-308-7724 for regular communications and (703)-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)-308-0956.

• Application/Control Number: 10/010,786

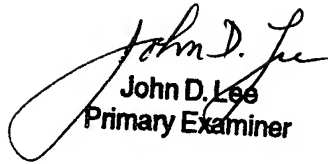
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A handwritten signature in black ink, appearing to be 'D. Lee'.

dv

May 29, 2003

A handwritten signature in black ink, appearing to be 'John D. Lee'.

John D. Lee
Primary Examiner